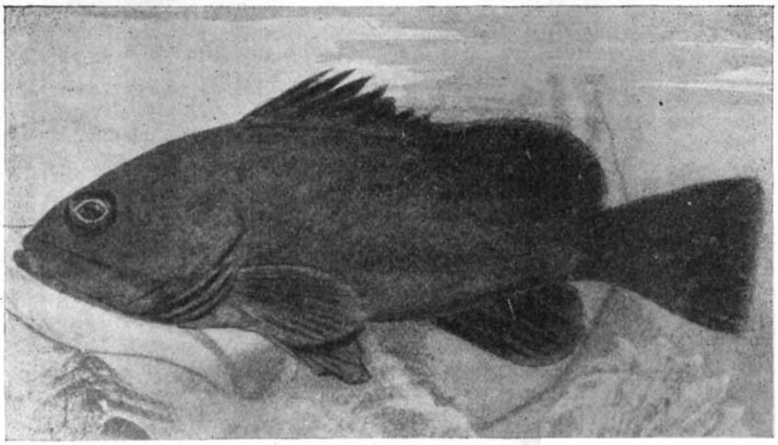
forms of government which give to the working class in the community an effective voice in policy and administration."

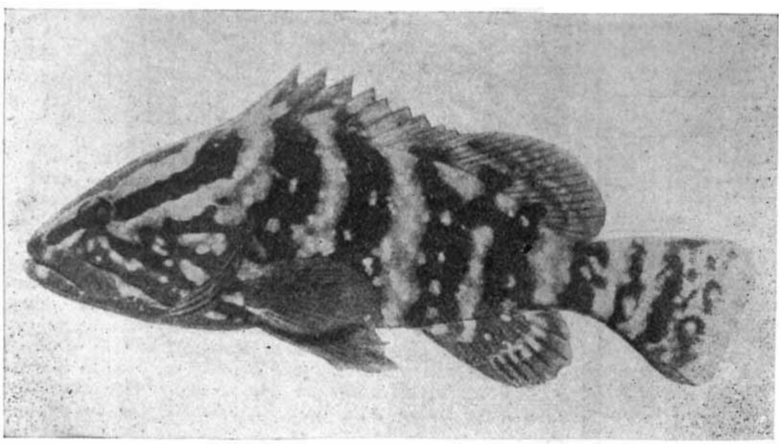
"The temper, the outlook, the recreations, and the ideals of a nation may be so refined and raised by the right kind of training as to secure for the mass of the people a more choiceworthy life." J. WILSON.

CHANGES IN COLOUR AMONG TROPICAL FISHES.

THE Zoological Society of New York recently issued a very interesting paper written by Mr. C. H. Townsend on the instantaneous changes of colour among tropical fishes (thirteenth annual report, 1909). The specimens came from the Bermudas, and are kept under favourable conditions in the aquarium of the society. The changes of coloration "begin to be in evidence within an hour of the arrival of new specimens, or as soon as they recover from the alarm produced by handling, and are produced as long as the fishes live in the tanks, which, in some cases, may be several years."



Dark Phase.



Banded Phase.

Two Colour-phases of the Nassau Grouper (*Epinephelus striatus*).

The phases of coloration are illustrated by a striking series of photographs, two of which are reproduced. From these it will be seen that the fish can pass from a uniformly dark (plumbeous) colour to a banded phase with white markings. Four other phases can also be assumed, including a uniformly creamy-white one. This plasticity of coloration is characteristic of most of the fish dealt with, which include Serranidæ, Scaridæ, Teuthididæ, and Scorpænidæ. There is frequently a pale and a dark monochrome phase when the fish is at rest. Under any excitement, such as the presence of visitors, the fish assumes a parti-coloured aspect. This paper clearly shows how inadequate and misleading are many of the descriptions of colour hitherto accepted, and is a very suggestive and attractive piece of work. An error occurs on p. 3, where it is said that "their different colours result from muscular action upon one or more kinds of cells." The mechanism of colour-change is not muscular, but nervous.

MINERAL OUTPUT OF THE UNITED STATES.[1]

THE well-known publication referred to below now appears in a form slightly different from the one to which we have hitherto been accustomed, being issued in two volumes, the first devoted to the Metallic products and the second to the Non-metallic products; this is done in consequence of a recent legislative enactment (Act of May 27, 1908), and presents some advantages, though it might be well to submit, with all respect, to the Government of the United States, that these (and sundry other) publications of the United States Geological Survey stand in far greater need of condensation than they do of expansion. When a work becomes unwieldy, there are two obvious remedies, either to issue it in two volumes or to compress the information it conveys into smaller compass; the latter is no doubt the more difficult proceeding, though the one that best serves the interests of the readers, and it is a matter of regret that, in this case, the line of least resistance has been followed. In the present instance it leads also to a few anomalies, as, for instance, the inclusion of crushed steel (as an abrasive) and of certain other metalliferous materials, such as arsenic, manganese, chromite, &c., in the volume devoted to non-metallic products.

It is greatly to be regretted that the mineral statistics of the United States are issued in a form that makes comparisons with the mineral output of other nations difficult; for example, the various values of the metals are reported, not in the form of ore, but in the metallic state, though obviously the value in this form includes the cost of reduction of the metal, and leads to very serious duplication, which the compilers appear to have overlooked, although the introduction lays stress on the statement that "all unnecessary duplication has been excluded." To take an example, the production of iron ore is not given, but instead of it that of the pig-iron smelted from it, namely, nearly 26 million tons, valued at about 530 million dollars. Now the production of coke for the same year was 40 million tons, produced from 62 million tons of coal, valued at nearly 73 million dollars. Practically the whole of the pig-iron produced was made with coke as fuel, and, in the absence of exact figures, it will probably be a near approximation to the truth if we assume that three-fourths of the coke production, or, say, 30 million tons, was consumed in the production of the above pig-iron, so that coal to the value of, say, 55 million dollars was utilised in this way, and this sum is accordingly included in the above valuation of the pig-iron production; it is, however, also included in the sum total of the value of the coal production, and thus enters twice

[1] Mineral Resources of the United States, Calendar Year 1907. Part I., Metallic Products. Pp. 742. Part II., Non-metallic Products. Pp. 897. (Washington: Government Printing Office, 1908.)

into the grand total of 1904 millions of dollars given as the value of the mineral productions of the United States. The same is true of every other metal on the list; in some cases, notably, perhaps, in that of aluminium, the value of the metallic product is many times greater than that of the mineral from which it is produced; thus the value of the aluminium produced is given as 5 million dollars, whilst that of the bauxite from which it is produced is about 450,000 dollars; surely it is the latter figure, and not the former, that should enter into a list of the values of the mineral productions of any country.

In the non-metallic products similar anomalies are also to be met with; cement, bricks, oilstones and millstones are articles that owe a very great, if not in every case the greater, part of their value to the labour, fuel, and power used in their preparation rather than to the crude material from which they are produced; if an American sculptor carves a statue out of native marble, should the value of the finished statue be included in the sum total of the value of the mineral resources? There can only be one answer to such a *reductio ad absurdum*, and yet the principle is exactly the same as that of including the value of the dressed grindstones instead of that of the sandstone or grit from which they are cut.

The above are matters of principle which present, no doubt, great difficulties in arriving at a satisfactory solution; the coordination of the methods of tabulating the mineral productions of different countries, so as to admit of just comparison, has often been tried, but has never been attained successfully yet, so that all that statisticians can do is to take care that they thoroughly understand the differences that obtain between the various systems in vogue. In other respects the present volumes are quite up to the high standard that we have been accustomed to in the United States Geological Survey publications. As already said, they suffer from want of compression, and there are many repetitions that might be avoided and much superfluous matter that might well be excised. In fact, they require more careful editing than they receive at present, and this is all the more necessary seeing that the different articles are written by different contributors, and are of very unequal value.

For example, no careful editor would pass such statements as we find under the item fluorspar, where we are told that the mineral is "only slightly harder than calcite, and consequently crushes easily," whereas the ease or difficulty of crushing has nothing to do with hardness; and again, "When fluorspar is associated with zinc-blende, complete separation of the two minerals has been difficult on account of their nearness in specific gravity"; the specific gravity of fluorspar is about 3·1, and that of blende about 4, a difference which should afford an ample margin for successful separation in a suitable appliance.

Finally, it may be pointed out that although these volumes in their final form may be considered somewhat belated, no serious inconvenience results therefrom, as the wise precaution is taken of issuing the various sections in pamphlet form as soon as possible after the end of the year to which they refer, an advance sheet of statistics being, moreover, issued usually with considerable rapidity. This is a procedure that might well be imitated with great advantage by a good many other nations, our own not excepted.

HENRY LOUIS.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE summer meeting of the Institution of Mechanical Engineers opened at Liverpool on Tuesday, July 27. The president, Mr. John A. F. Aspinall, and the council and members of the institution, were welcomed in the lecture hall of the Municipal Central Technical School by the Lord Mayor of Liverpool, Councillor H. Chaloner Dowdall, and the members of the Liverpool reception committee. The importance of Liverpool as an engineering centre secured an attendance of nearly 500 members, who participated in the excellent arrangements made regarding visits to works and excursions. The institution dinner was held in the Exchange Station Hotel on Tuesday evening, and the Lord Mayor and Lady Mayoress of Liverpool received the visitors in the Town Hall on Wednesday evening. Meetings were held for the reading and discussion of papers on Tuesday and Wednesday mornings in the Municipal Central Technical School. Brief extracts from these are subjoined.

Locomotives designed and built at Horwich were described in a paper by Mr. George Hughes, who is the chief mechanical engineer of the Lancashire and Yorkshire Railway. This company possesses 1517 locomotives, of which there are about 1100 in daily use. When the works at Horwich were opened, Mr. Aspinall, president of the institution, and at that time chief mechanical engineer, resolved to introduce standardisation and, wherever possible, interchangeability. Joy's valve gear was adopted, as it was found that the mileage between repairs was greater, and also that there was a slight economy in coal per engine-mile.

Among other types of locomotives described it is of interest to note six engines which were fitted in 1902 with Druitt-Halpin thermal storage tanks. Where stopping places are frequent on rising gradients there is distinct economy. Certain tests carried out between Salford and Accrington resulted in a saving of one ton of water, and under similar conditions elsewhere the saving was 12 per cent. On other sections of the line, which are not so favourable, the all-round economy of these engines is brought down to 4 per cent.

A four-cylinder passenger and express goods engine, built to the author's designs in June, 1908, is also of interest. Absolutely perfect balancing could have been achieved without the aid of balance weights if the crank angles, the disposition of the cylinders, and the weights of the reciprocating parts had been arranged to neutralise amongst themselves the reciprocating disturbing forces; then, by balancing the revolving masses, the variations of rail load and the horizontal swaying couple would have disappeared. Excepting for a slight vertical component produced by the obliquity of the connecting-rod, the engine would then have been perfectly balanced. This arrangement, known as the Yarrow-Schlick-Tweedy system, would have involved an independent set of valve gear for each cylinder. Actually, the cranks were arranged in pairs at about 180° apart respectively, and the reciprocating masses, being made equal in weight, balance each other. The masses of the connecting-rods were divided between the rotating and reciprocating masses as suggested by Prof. Dalby, and the revolving masses were balanced by revolving balance weights. This engine is a very steady and smooth-running machine.

The discussion centred round the important questions of boiler deterioration, corrosion, and priming. Mr. Hurry Riches expressed the opinion that the best way of avoiding troubles due to the nature of the feed-water is to remove the impurities before feeding into the boiler; it is, however, inadvisable to reduce the hardness of feed-water below 6°.

A paper on reinforced concrete was contributed by Mr. Arthur C. Auden, of the firm of Messrs. William Cubitt and Co. Reinforced concrete is by no means a new thing; it has passed the experimental stage, as is evidenced by important structures erected in London in 1889, and still in use. On the Continent equally large structures exist which are now twenty-five years old, and have never been strengthened or patched. Failures have occurred through bad design or workmanship, but the proportion of these is small. The cost of the proposed structure is affected by the cost of its constituents, and these in turn by the cost of freight and carriage. Hence the author briefly classifies the materials, and gives useful hints on the properties of each.

For aggregates, the eastern counties' flint is often the only stone available locally. Good, tough concrete can be made with this, but is untrustworthy for fire-resisting purposes, owing to its tendency to crack and "fly" under heat. This tendency can be much reduced by first crushing all the stones. The same remarks apply to limestone, a material which is not more fire-resisting after being broken. As it is apt to disintegrate to powder under the action of heat, it is inadvisable to use this material where fire-resistance is an important consideration. Limestone always requires washing before use to get rid of the fine dust which covers it and prevents the cement properly